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Why the U.S. Power Grid's Days Are Numbered

By [Chris Martin](#), [Mark Chediak](#), and [Ken Wells](#) August 22, 2013

There are 3,200 utilities that make up the U.S. electrical grid, the largest machine in the world. These power companies sell \$400 billion worth of electricity a year, mostly derived from burning fossil fuels in centralized stations and distributed over 2.7 million miles of power lines. Regulators set rates; utilities get guaranteed returns; investors get sure-thing dividends. It's a model that hasn't changed much since Thomas Edison invented the light bulb. And it's doomed to obsolescence.

That's the opinion of David Crane, chief executive officer of NRG Energy, a wholesale power company based in Princeton, N.J. What's afoot is a confluence of green energy and computer technology, deregulation, cheap natural gas, and political pressure that, as Crane starkly frames it, poses "a mortal threat to the existing utility system." He says that in about the time it has taken cell phones to supplant land lines in most U.S. homes, the grid will become increasingly irrelevant as customers move toward decentralized homegrown green energy. Rooftop solar, in particular, is turning tens of thousands of businesses and households into power producers. Such distributed generation, to use the industry's term for power produced outside the grid, is certain to grow.

Crane, 54, a Harvard-educated father of five, drives himself to work every day in his electric Tesla Model S. He gave his college-age son an electric Nissan Leaf. He worries about the impact of warming on the earth his grandchildren will inherit. And he seems to relish his role as utility industry gadfly, framing its future in Cassandra-like terms. As Crane sees it, some utilities will get trapped in an economic death spiral as distributed generation eats into their regulated revenue stream and forces them to raise rates, thereby driving more customers off the grid. Some customers, particularly in the sunny West and high-cost Northeast, already realize that "they don't need the power industry at all," Crane says.

He's not alone in his assessment, though. An unusually frank January report by the Edison Electric Institute (EEI), the utilities trade group, warned members that distributed generation and companion factors have essentially put them in the same position as airlines and the telecommunications industry in the late 1970s. "U.S. carriers that were in existence prior to deregulation in 1978 faced bankruptcy," the report states. "The telecommunication businesses of 1978, meanwhile, are not recognizable today." Crane prefers another analogy. Like the U.S. Postal Service, he says, "utilities will continue to serve the elderly or the less fortunate, but the rest of the population moves on." And while his utility brethren may see the grid as "the one true monopoly, I'm working for the day the grid is diminished."

Anthony Earley Jr., CEO of giant Pacific Gas & Electric, doesn't share Crane's timetable for the coming disruption—he thinks it's further out—but he does agree about the seriousness of the threat. Solar users drain revenue while continuing to use utility transmission lines for backup or to sell their power back to the power company. How can power companies pay for necessary maintenance and upgrades of the grid if that free ride

continues? “No less than the stability of the grid is at stake,” he says. So far regulators in Louisiana, Idaho, and California have rejected calls to impose fees or taxes on solar users.

Worldwide revenue from installation of solar power systems will climb to \$112 billion a year in 2018, a rise of 44 percent, taking sales away from utilities, according to analysts at Navigant Research, which tracks worldwide clean-energy trends. “Certain regions in California, Arizona, and Hawaii are already feeling the pain,” says Karin Corfee, a managing director of Navigant’s energy practice. “We’ll see a different model emerge.”

After subsidies, solar power is competitive with grid power costs in large parts of those markets. Some areas in the Northeast will reach a similar “grid parity”—where residential solar is equal in cost to power from a utility—within three years; a majority of states could get there in 10 years or less, according to data from a variety of green energy and regulatory sources. A July report by Navigant says that by the end of 2020, solar photovoltaic-produced power will be competitive with retail electricity prices—without subsidies—“in a significant portion of the world.” Green-thinking communities such as San Francisco and Boulder, Colo., are starting to bypass local utility monopolies to buy an increasing portion of power from third-party solar and wind providers. Chicago recently doubled the amount of power it buys from downstate wind farms.

The solar and distributed generation push is being speeded up by a parallel revolution in microgrids. Those are computer-controlled systems that let consumers and corporate customers do on a small scale what only a Consolidated Edison or Pacific Gas & Electric could do before: seamlessly manage disparate power sources without interruption. Microgrids have long been used to manage emergency backup power systems. A 26-megawatt microgrid completed in 2011 kept the power on at the U.S. Food and Drug Administration’s White Oak research center in the aftermath of Hurricane Sandy last year. It also saves the federal government an estimated \$11 million a year in electricity costs. The microgrid’s ultimate potential, however, is in turning every person, company, or institution with a renewable energy power system into a self-sustaining utility. Imagine your house switching from power it generates itself to power from the grid the way a Toyota ([TM](#)) Prius switches from battery power to gasoline.

Outside the makeshift offices of Sunora Energy Solutions, in suburban Phoenix, the thermometer reads 112F on a recent afternoon as Crane takes a seat and begins explaining his plans to adapt to a post-grid world. While NRG’s main business remains supplying electricity to utilities in the wholesale market from Staten Island, N.Y., to San Diego, Crane has overseen about \$1 billion in solar and green-tech investments, including a 50 percent stake in the 290-megawatt Agua Caliente utility-scale solar plant in Arizona due to be completed in 2014. (A Warren Buffett-controlled enterprise owns the other half.) Last year, NRG bought a 50 percent stake in 22-month-old Sunora for an undisclosed sum. Its business is stealing the revenue stream of the very companies NRG sells power to.

Sunora has only a few dozen employees and an overhead befitting its warehouse location. Still, it’s abuzz with ideas to tap into the changes detailed in the EEI report. Its engineers have come up with solar canopies that can be installed in supermarket and department store parking lots or above drive-up ATMs. They provide shade and generate clean power that can be used by the buyer or sold back to the grid. Sunora says it has pitched a mass purchase of canopies to a large U.S. retailer for its parking lots, though it won’t name the company. For customers who think the canopies are too industrial-looking, Sunora developed a decorative solar pergola—a kind of standalone patio—that provides the output of a rooftop system without cluttering the roof with solar panels. It can be installed in two days. Crane says he can sell lots of them to luxury hotels, though he hasn’t yet. Sunora is also working with DEKA, a Manchester (N.H.) technology-development

company, on a microgrid package for homeowners. The price isn't set yet, but Sunora executives say they hope to start selling a 10-kilowatt residential system for about \$20,000 in 2015.

Businesses are adopting solar and smart microgrids at an escalating rate to beat rising power costs and burnish their green cred. Verizon is investing \$100 million in solar and fuel-cell projects that will directly supply 19 offices and data centers in three states. Wal-Mart Stores, with 4,522 locations in the U.S., expects to have 1,000 solar-powered stores by 2020. MGM Resorts International's Mandalay Bay resort convention center in Las Vegas hired NRG to install a 6.2-megawatt solar system—enough to meet as much as 20 percent of Mandalay Bay's demand. Wal-Mart U.S. President Bill Simon extolled the virtues of the company's solar program in March when he told an analyst at an investor meeting that solar was often cheaper than grid power. Besides, Wal-Mart has a lot of roofs, and “roofs are big places where we can gather a lot of solar,” Simon said.

In full pitch mode, Crane sees an “underserved market” for NRG in bringing solar to businesses—from grocery stores to office buildings to athletic stadiums—requiring from 100 kilowatts to 10 megawatts of power. At Lincoln Financial Field, home of the Philadelphia Eagles, NRG installed a \$30 million system of more than 11,000 solar panels and 14 mini wind turbines that can supply about a third of the stadium's needs.

When Crane is asked whether he, CEO of a company that gets nearly all of its \$8.4 billion revenue from selling coal-powered electricity to utilities, risks alienating his traditional customers, he says the changing world requires changing strategies. He then crisply runs through his vision of how the next two to three decades play out. The grid continues to shrink—U.S. power use actually peaked in 2007—as distributed generation captures an increasing share from utility-generated power. There won't be much need for new large-scale transmission lines after that, except perhaps to gather and distribute power from remote wind farms. Crane says at least some existing transmission lines “are about to become stranded costs”—utilities simply won't require the capacity they have now.

As for utilities themselves, Crane says there will always be a need to provide what's called the “base load”—the minimum amount of power to keep essential services running—but no need for as many utilities as there are now. Most coal- and oil-fired plants are destined for extinction, including NRG's own 16 plants, which Crane wants to close sooner rather than later. “Natural gas is already wiping out coal, and it's going to wipe out most nuclear,” he says. “There will be only a handful of nukes that we'll need to keep running as base load plants.”

This is going to set off the scramble for market among existing utilities that the EEI report anticipates. Says Crane: “There's going to be a strong fight to preserve share.”

No industry as large, long-lived, powerful, and politically connected as the utility industry will simply roll over, disruptive technology or not. Wander into the annual meeting of the EEI, and you can get a sense of the push back. At this year's event, held in June at the Marriott Marquis in San Francisco, some 950 utility executives, consultants, and support staff talk shop and offer arguments for why the grid will survive. Solar doesn't work everywhere; it still doesn't make economic sense in states that have low-cost coal power; microgrids aren't foolproof. And someone has to pay for those wires used to sell solar power back to the grid.

The big complaint, though, is about subsidies. “I don't characterize distributed generation in and of itself as a threat,” says Nick Akins, CEO of Columbus (Ohio)-based American Electric Power. “I characterize the regulatory scheme that supports it as a threat.”

Theodore Craver, CEO of Edison International, owner of California's second-biggest utility, says subsidies create "false economic signals" for rooftop solar. He estimates that 44,000 of his customers got more than a half a billion dollars in incentives to install solar systems, a total that doesn't include the amounts they're getting for selling their power back to the utility. California utilities project that under current policies, solar users' savings add about \$1.3 billion to nonsolar users' bills. In other words, people who don't want or can't afford to install solar are paying for those who do. "And that ends up shifting a lot of the costs of maintaining the system to those who do not have means," Craver says.

This is the theme repeated over and over at the conference: Subsidized renewables, solar in particular, have become a matter of inequity, a challenge to "social fairness" by shifting costs to nonadopters. For Christopher Johns, president of PG&E, the solution is to roll back the subsidies to level the playing field. He has cause to worry. About one-fourth of all residential solar systems in the U.S. are installed in PG&E's 70,000-square-mile territory. "We ought to look at what's the transition period where we start to roll this off and allow them to stand on their own," he says.

Michael Peevey has a lot to say about this, as he might. Years ago he served as president of Southern California Edison and is now in his second term as president of the California Public Utilities Commission. He's heard the arguments from both sides. In his San Francisco office, the walls are decorated with pictures of Peevey with Cesar Chavez and former California Governor Pat Brown. He expresses a modicum of sympathy for the companies he regulates. The quick growth of solar has surprised many, he says; the subsidy arguments aren't necessarily unreasonable. In some states, regulation inhibits utilities from venturing into green energy.

Some power companies do seem to be adapting, or are at least trying to. Duke Energy, the largest utility in the U.S., has built 1,600 megawatts of wind generation and 100 megawatts of solar since entering the renewables business in 2007. Southern Co. of Atlanta, operator of some of the most emission-heavy coal plants in the nation, has joined with billionaire Ted Turner to invest in five solar projects that will make it one of the largest utility owners of solar in the nation.

In the main though, utilities "hold their own fate in their hands," according to Peevey. "They can do nothing but complain or moan about technological change or they can try to adapt," he says. "The California utilities would have been very smart, five, six, eight years ago to get into the solar business themselves and put the solar panels on people's homes. They could have done this, and put it into rate base." Peevey, in fact, says he recommended they do just that, to no avail. "It's not their culture," he says. "They told me that. 'It's not our culture.'"

"Renewable energy is so unlike fossil fuel energy," says John Farrell, a senior researcher with the Minneapolis-based Institute for Local Self-Reliance, a group pushing distributed generation. "You don't need large amounts of capital to build it, you don't need to produce it all in one place and use high-voltage transmission lines to transport it somewhere else. The idea that we would continue to have a centralized form of ownership and control of that system is really inconsistent with what the technology enables."

Farrell is a supporter of distributed power. However, the Bernstein energy industry black book, a kind of bible of energy trends published by Sanford C. Bernstein that's followed devoutly by institutional investors, also predicts that parity in the cost of unsubsidized solar and conventional electricity will radically change the energy dynamic. "The technology and energy sectors will no longer simply be one another's suppliers and customers," the report says. "They will be competing directly. For the technology sector, the first rule is: Costs always go down. For the energy sector and for all extractive industries, costs almost always go up. Given those trajectories, counterintuitively, the coming tussle between solar and conventional energy is not

going to be a fair fight.”

With Jim Polson

[Martin](#) is a reporter for Bloomberg News in New York.

[Chediak](#) is a reporter for Bloomberg News in San Francisco.

[Wells](#) is a reporter for Bloomberg News in New York.

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